REMARKS/ARGUMENTS

Reconsideration of the application is requested.

The following responds to the further non-final Office action dated June 1, 2004. The Examiner's cooperation in withdrawing the finality of the prior action of March 1, 2004 and the granting of applicants' petition of March 30, 2004 is appreciated. In light of the considerable efforts already expended in this application, the Examiner is requested to carefully review all of the remaining issues and applicants' following arguments in support of patentability. The Examiner is further requested to cooperate with counsel in order to further the issues and, if at all possible, to bring the examination to a close. Any telephone calls from the Examiner to counsel will be expeditiously handled.

Claims 12-26 are now in the application. Claims 24-26 have been added. The added claims are supported in the original specification, to wit:

- Claim 24 is a combination of claim 12 and a part of claim 18 (originally claim 6).
- Claim 25 corresponds to claim 12, with the added limitation that the deposition process is effected with low pressure chemical vapor deposition. The latter

feature appears on page 8 of the specification, middle paragraph.

- Claim 26 finds support in claim 12 and in claim 20 (originally claim 10). Support for the changed dilution range is found page 14, line 22 (40 sccm SiH_4 to 400 sccm N_2) and on page 15, line 17 (40 sccm SiH_4 to 200 sccm N_2).

We now turn to the art rejection, in which the claims have been rejected as being obvious over a combination of Thakur et al. (6,187,628 "Thakur") with Lin et al. (6,127,221 "Lin") or with Yew et al. (5,753,359 "Yew") under 35 U.S.C. § 103. We respectfully traverse.

Before delving into the details of the various claims vis-à-vis the combination of the art references we must take issue with the very combination, *ab initio*. The references, as it turns out, are not properly combinable.

Lin relates to a multi-step grain growing process which corresponds with the process described on page 2, second paragraph, of the specification. The prior art process includes the following steps:

- deposition of amorphous silicon;
- HF-Dip cleaning;

- seeding with SiH_4; and
- anneal in N_2 for growing the grains from the seeds using the amorphous silicon.

Thakur, of course, provides for a different process sequence for growing a hemispherical grain polysilicon layer on a substrate, as outlined, for example, in the Abstract:

- silicon deposition by CVD;
- without removing the substrate from the CVD reactor, oxidizing the silicon layer to grow a layer of silicon dioxide or, alternatively, depositing an oxide layer by CVD;
- without removing the substrate from the CVD reactor, depositing HG polysilicon on the silicon dioxide layer by CVD.

It is quite clear that the two process sequences <u>cannot</u> be combined for technological reasons. Besides, there is neither a hint nor a proper suggestion as to why a person of skill in the art would combine the teachings.

Furthermore, even if the combination were possible and the combination were obvious, one would still not arrive at the claimed invention. The independent claims herein require that

the HSG grains be formed in a single process step directly from the process gas on a (oxide or nitride) substrate surface without a subsequent annealing step for growing the grains, and that the process parameters be set so as to provide HSG growth with clear spacing in between the grains, i.e., with exposed portions of the (oxide or nitride) substrate surface.

The alternatively applied secondary reference to *Yew* relates to a plasma process. The primary reference *Thakur* and the claimed invention, of course, as well as *Lin*, pertain to processes where no plasma is used. This certainly would appear to be a technological difference that immediately disqualifies *Yew* as a proper reference in the context.

The primary reference *Thakur* does not provide a hint towards the formation of a "clear spacing" between the grains. In fact, the reference states quite the opposite. The HSG layer 20 is said to have a preferred thickness

"from 300 Angstroms to 1000 Angstroms"

See *Thakur*, col. 3, lines 39-41. A layer of this thickness would not retain a "clear spacing" between individual semiconductor grains.

The secondary reference *Lin* refers only to spaces between the seeds but not between the complete grains after annealing.

The secondary reference *Yew* does not provide a hint that spaces between grains can be achieved without using a plasma.

Because of these technological differences, the cited documents do not counsel towards narrowing the extremely broad and generalized parameters of *Thakur* to the very narrow parameter ranges that would lead to clear spacing between grains as claimed in the context.

It follows logically that neither claim 12 nor any of the other independent claims is obvious.

Turning now to the added claim 24, we see that this yet narrower claim is very clearly patentable over the art of record. Claim 24 adds a limitation according to which the substrate surface upon which the HSG is grown is an oxide surface or a nitride surface. This measure prevents the formation of relatively large, irregular grains as in the case of an HF-dip cleaned silicon surface.

In addition to the more general argument above, one must also consider here that only *Thakur* relates to a method where the

HSG grains are grown on an oxide. As noted, however, *Thakur* provides no teaching towards producing lateral spaces between the grains.

The secondary teachings of *Lin* and *Yew* relate to entirely different processes for growing grains on silicon. Therefore, there exists a further reason that prevents an obvious combination of the teachings of these documents in an obvious manner with the teaching of *Thakur*.

Claim 24 is patentable over the art of record.

Claim 25 adds a further limitation by requiring that the process be performed in a low pressure chemical vapor deposition furnace (LPCVD).

The process according to *Lin* is performed in an UHV-system (Ultra High Vacuum, $1.0 \cdot 10^{-3}$ Torr). The process according to *Yew* is performed in a ECD-CVD-system (Electron Cyclotron Resonance CVD), i.e., with a plasma.

In contrast, only the teachings according to *Thakur* (and *Lin* '219, for that matter) can be performed in a LPCVD reactor. The different systems are a further reason for not combining the teachings as proffered by the Examiner. An especially

impossible combination would be between *Thakur* and *Yew*, disclosing the only single step processes for growing grains.

Claim 25 is patentable over the art of record.

Claim 26 adds a further limitation by requiring that the process gas be diluted with N_2 in a dilution range from 1:10 to 1:5.

The secondary reference *Lin* '221 relates to an UHV method with a flow concentration of $1.0 \cdot 10^{-3}$ moles/m^3. This is a typical partial pressure for UHV. No teaching is found in the reference towards a dilution of silane.

The non-applied reference *Lin* '219 relates to a very high nitrogen dilution, which is greater than 1:10 because for selectivity of the process, a low partial pressure of silane is necessary as for the UHV method.

Due to the fact that the partial pressure relates to the selectivity, it is not possible to state that roughness is directly proportional to silane dilution. Furthermore, the teachings of *Lin* to not provide a hint towards the dilution within the range from 1:10 to 1:5.

In summary, none of the references, whether taken alone or in any combination, either show or suggest the features of any of the independent claims. All of the claims are patentable over the art of record.

Enclosed herewith is counsel's payment in the amount of $ 258.00 for three extra independent claims over three. Please charge any deficiencies in fees to counsel's deposit account 12-1099.

In view of the foregoing, reconsideration and allowance of claims 12-26 are solicited.

Respectfully submitted,

For Applicants

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